

I claim:

1. A ram for use in the horizontal bore of a wellhead production blowout preventer to close off the vertical bore of the well, said ram having front and rear ends, a longitudinal axis and being adapted to seal at its front end against either a polish rod of a rod string or an adjacent ram, said ram comprising:

a body component with front and rear portions and ends;

a seal component with front and rear portions and ends;

said body component having an arcuate longitudinal outer surface for conforming with the horizontal bore surface, and having a cut-out in its front portion which provides a seal support surface to support the seal component in both a vertical and horizontal direction;

said seal component having an arcuate longitudinal outer surface for conforming with the horizontal bore surface, and an inner surface which generally conforms to the seal support surface of the body component;

said body component and seal component combining, in an assembled form, to form a full bore ram body, which when out of sealing engagement has the front end of the seal component protruding a horizontal distance  $d$  beyond the front end of the body component;

connectors for connecting the seal and body components while allowing the seal component, during sealing engagement, to be pressed against the seal support surface of the body component; and

said seal component providing a sealing surface formed of thermoplastic material around the arcuate outer surface for sealing against the horizontal bore;

so that, as the body component is advanced forwardly into a sealing engagement causing the front end of the seal component to contact either the adjacent ram or the polish rod to seal off the vertical bore, the seal component is pressed against the seal support surface of the body component such that the thermoplastic sealing surface is compressed outwardly to seal against the horizontal bore.

2. The ram of claim 1, wherein the thermoplastic sealing surface of the seal component includes a raised ridge sealing surface formed of thermoplastic material around the arcuate outer surface for sealing against the horizontal bore.
3. The ram of claim 2, wherein the raised ridge sealing surface includes one or both of a peripheral raised ridge sealing surface located at the peripheral edges of the seal component adjacent the body component, or a vertical bore raised ridge sealing surface located at the front end of the seal component in the area which is exposed to the vertical bore when in a sealing engagement.
4. The ram of claim 3, wherein the seal component is formed from a thermoplastic material and wherein the vertical bore raised ridge sealing surface, if present, is either preformed by forming a reduced radius portion on the outer arcuate surface of the seal component, or by forming the raised ridge sealing surface in situ by sealing the ram against the vertical bore.
5. The ram of claim 4, wherein the seal component is formed of thermoplastic material, and wherein the peripheral raised ridge sealing surface, if present, is formed by forming a reduced radius portion on the outer arcuate surface of the seal component to form the peripheral raised ridge surface at its peripheral edges adjacent the body component.
6. The ram of claim 1, wherein the seal support surface of the body component and the inner surface of the seal component are both generally L-shaped, said seal support surface having a horizontal support surface which is generally parallel to the horizontal axis of the ram, and a rear support surface which is rearwardly inclined relative to the vertical, such that in sealing engagement, the seal component is pressed against the horizontal and rear support surfaces so as to compress the thermoplastic sealing surface outwardly against the horizontal bore.
7. The ram of claim 4, wherein the seal support surface of the body component and the inner surface of the seal component are both generally L-shaped, said seal support surface having a horizontal support surface which is generally parallel to the horizontal axis of the ram, and a rear support surface which is rearwardly inclined relative to the vertical, such that in sealing engagement, the seal component is pressed against the

horizontal and rear support surfaces so as to compress the thermoplastic sealing surface outwardly against the horizontal bore.

8. The ram of claim 1, wherein the seal support surface of the body component forms an acutely angled surface, relative to its longitudinal axis, against which the seal component is pressed during sealing engagement to seal off the vertical and horizontal bores.

9. The ram of claim 4, wherein the seal support surface of the body component forms an acutely angled surface, relative to its longitudinal axis, against which the seal component is pressed during sealing engagement to seal off the vertical and horizontal bores.

10. The ram of claim 9, wherein the seal component and the cut-out portion of the body component are both generally wedge shaped, with the wide end of the wedge shaped seal component being the front end.

11. The ram of claim 1, wherein the seal support surface of the body component and the inner surface of the seal component are both generally L-shaped.

12. The ram of claim 7, wherein the seal support surface of the body component and the inner surface of the seal component are both generally L-shaped.

13. The ram of claim 12, wherein the L-shaped seal support surface of the body component forms an acutely angled surface, relative to its longitudinal axis; wherein the body component and seal component, when combined in the assembled form, form a gap, whose horizontal width is less than  $d$ , between the seal and body components at the rear end of the seal component, and wherein the L-shaped inner surface of the seal component is adapted to ride upwardly and rearwardly on the acutely angled surface of the body component during sealing engagement to close the gap and to compress the seal component outwardly to seal against the horizontal bore.

14. The ram of claim 12, wherein the seal component is formed in two parts, a steel ram insert forming a groove at its front end and its peripheral edges adjacent the body component, and a thermoplastic seal insert held in the groove, said thermoplastic seal insert forming the peripheral raised ridge sealing surface.

15. The ram of claim 13, wherein the seal component is formed in two parts, a lower steel wedge portion and an upper thermoplastic seal portion, which are connected together with connectors to form the seal component, and wherein the lower wedge portion forms the angled surface at its lower surface which rides on the angled surface of the body component.

16. The ram of claim 14, wherein the seal component is formed in two parts, a lower steel wedge portion and an upper thermoplastic seal portion, which are connected together with connectors to form the seal component, and wherein the lower wedge portion forms the angled surface at its lower surface which rides on the angled surface of the body component.

17. The ram of claim 13, wherein the body component is formed in two parts, a rear plate portion and a front wedge portion, which are connected together with connectors to form the L-shaped body component.

18. The ram of claim 14, wherein the body component is formed in two parts, a rear plate portion and a front wedge portion, which are connected together with connectors to form the L-shaped body component.

19. The ram of claim 15, wherein the body component is formed in two parts, a rear plate portion and a front wedge portion, which are connected together with connectors to form the L-shaped body component.

20. The ram of claim 1, wherein the front end of the seal component provides a sealing face to seal against either the polish rod or the sealing face of an opposing ram, and wherein the sealing face includes a cut-away portion such that a reduced area of the sealing face forms the seal.

21. The ram of claim 7, wherein the front end of the seal component provides a sealing face to seal against either the polish rod or the sealing face of an opposing ram, and wherein the sealing face includes a cut-away portion such that a reduced area of the sealing face forms the seal.

22. The ram of claim 9, wherein the front end of the seal component provides a sealing face to seal against either the polish rod or the sealing face of an opposing ram,

and wherein the sealing face includes a cut-away portion such that a reduced area of the sealing face forms the seal.

23. The ram of claim 10, wherein the front end of the seal component provides a sealing face to seal against either the polish rod or the sealing face of an opposing ram, and wherein the sealing face includes a cut-away portion such that a reduced area of the sealing face forms the seal.

24. The ram of claim 12, wherein the front end of the seal component provides a sealing face to seal against either the polish rod or the sealing face of an opposing ram, and wherein the sealing face includes a cut-away portion such that a reduced area of the sealing face forms the seal.

25. The ram of claim 13, wherein the front end of the seal component provides a sealing face to seal against either the polish rod or the sealing face of an opposing ram, and wherein the sealing face includes a cut-away portion such that a reduced area of the sealing face forms the seal.

26. The ram of claim 14, wherein the front end of the seal component provides a sealing face to seal against either the polish rod or the sealing face of an opposing ram, and wherein the sealing face includes a cut-away portion such that a reduced area of the sealing face forms the seal.

27. The ram of claim 16, wherein the front end of the seal component provides a sealing face to seal against either the polish rod or the sealing face of an opposing ram, and wherein the sealing face includes a cut-away portion such that a reduced area of the sealing face forms the seal.

28. The ram of claim 1, wherein the front portion of the body component is generally T-shaped with two cut-outs providing two seal support surfaces, and wherein the ram includes two seal components, each adapted to be pressed against one of the seal support surfaces during sealing engagement and each having the front end protruding beyond the front end of the body component.

29. The ram of claim 7, wherein the front portion of the body component is generally T-shaped with two cut-outs providing two seal support surfaces, and wherein the ram includes two seal components, each adapted to be pressed against one of the seal

support surfaces during sealing engagement and each having the front end protruding beyond the front end of the body component.

30. The ram of claim 9, wherein the front portion of the body component is generally T-shaped with two cut-outs providing two seal support surfaces, and wherein the ram includes two seal components, each adapted to be pressed against one of the seal support surfaces during sealing engagement and each having the front end protruding beyond the front end of the body component.

31. The ram of claim 10, wherein the front portion of the body component is generally T-shaped with two cut-outs providing two seal support surfaces, and wherein the ram includes two seal components, each adapted to be pressed against one of the seal support surfaces during sealing engagement and each having the front end protruding beyond the front end of the body component.

32. The ram of claim 12, wherein the front portion of the body component is generally T-shaped with two cut-outs providing two seal support surfaces, and wherein the ram includes two seal components, each adapted to be pressed against one of the seal support surfaces during sealing engagement and each having the front end protruding beyond the front end of the body component.

33. The ram of claim 13, wherein the front portion of the body component is generally T-shaped with two cut-outs providing two seal support surfaces, and wherein the ram includes two seal components, each adapted to be pressed against one of the seal support surfaces during sealing engagement and each having the front end protruding beyond the front end of the body component.

34. The ram of claim 14, wherein the front portion of the body component is generally T-shaped with two cut-outs providing two seal support surfaces, and wherein the ram includes two seal components, each adapted to be pressed against one of the seal support surfaces during sealing engagement and each having the front end protruding beyond the front end of the body component.

35. The ram of claim 16, wherein the front portion of the body component is generally T-shaped with two cut-outs providing two seal support surfaces, and wherein

the ram includes two seal components, each adapted to be pressed against one of the seal support surfaces during sealing engagement and each having the front end protruding beyond the front end of the body component.

36. The ram of claim 1, wherein the seal and body components are formed with a vertical radial groove at their front edges to accommodate the polish rod.

37. The ram of claim 7, wherein the seal and body components are formed with a vertical radial groove at their front edges to accommodate the polish rod.

38. The ram of claim 9, wherein the seal and body components are formed with a vertical radial groove at their front edges to accommodate the polish rod.

39. The ram of claim 10, wherein the seal and body components are formed with a vertical radial groove at their front edges to accommodate the polish rod.

40. The ram of claim 12, wherein the seal and body components are formed with a vertical radial groove at their front edges to accommodate the polish rod.

41. The ram of claim 13, wherein the seal and body components are formed with a vertical radial groove at their front edges to accommodate the polish rod.

42. The ram of claim 14, wherein the seal and body components are formed with a vertical radial groove at their front edges to accommodate the polish rod.

43. The ram of claim 16, wherein the seal and body components are formed with a vertical radial groove at their front edges to accommodate the polish rod.

44. A production blowout preventer, comprising:

a housing forming a vertical bore extending longitudinally therethrough and a pair of coaxial horizontal ram bores, each having a longitudinal axis and a horizontal bore surface, extending transversely thereof, and intersecting the vertical bore;

a pair of rams positioned in the ram bores, each ram having front and rear ends, the rams being slidable along the ram bores so as to project into the vertical bore where their front ends may seal either against each other or against a polish rod of a rod string extending therethrough; and

means for advancing and withdrawing the rams between sealing and open positions;

each ram comprising:

a body component with front and rear portions and ends;  
a seal component with front and rear portions and ends;  
said body component having an arcuate longitudinal outer surface for conforming with the horizontal bore surface, and having a cut-out in its front portion which provides a seal support surface to support the seal component in both a vertical and horizontal direction;  
said seal component having an arcuate longitudinal outer surface for conforming with the horizontal bore surface, and an inner surface which generally conforms to the seal support surface of the body component;  
said body component and seal component combining, in an assembled form, to form a full bore ram body, which when out of sealing engagement has the front end of the seal component protruding a horizontal distance  $d$  beyond the front end of the body component;  
connectors for connecting the seal and body components while allowing the seal component, during sealing engagement, to be pressed against the seal support surface of the body component; and  
said seal component providing a sealing surface formed of thermoplastic material around the arcuate outer surface for sealing against the horizontal bore;  
so that, as the body component is advanced forwardly into a sealing engagement causing the front end of the seal component to contact either the adjacent ram or the polish rod to seal off the vertical bore, the seal component is pressed against the seal support surface of the body component such that the thermoplastic sealing surface is compressed outwardly to seal against the horizontal bore.